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Progress Report

ATMOSPHERIC INFRARED SOUNDER

NASA CONTRACT NAS5-31376

for the period

June 16, 1995 - December 15, 1995

Submitted to Team Leader
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Studies of comparative retrieval accuracy with AMSU-B and alternative instruments were presented at the AIRS team meeting in Suitland, MD. Work on combined AIRS/AMSU retrievals was also presented. These results are described in the previous semiannual report.

The microwave rapid transmittance algorithm[1] was revised to allow computation of transmittance at variable pressure levels. This change is expected to make the algorithm more generally useful.

In the "microwave first-guess" algorithm, a cloud liquid water parameterization similar to the one described by Sundqvist, et. al[2], which also is used in NMC's eta model, has been inserted in the routine that processes AMSU-B brightness temperatures to retrieve water vapor and liquid profiles. This modification considers that radiance collected by the antenna potentially originates from both clear and cloudy regions. The fractional cloud cover at each level is a function of relative humidity in the clear air. Cloudiness starts at a threshold relative humidity which currently is set at 75% over land and 80% over ocean. Complete cloud cover occurs at relative humidity of 100%. The convergence test in the moisture profile retrieval was modified to require either a match of the brightness temperatures within measurement errors (comprising noise and surface emissivity errors) or no change of more than 1% in residual variance from the previous iteration. The revised software package was delivered to JPL in December.

The two-layer cloud test simulations were reprocessed following the algorithm modifications described above. These "microwave first-guess" profiles were delivered to JPL in November, to be made available to other team members. Figure 1 shows the true temperature, water vapor and liquid water along the 2-layer simulation A track, as vertical cross sections. This track has a temperature inversion layer with very dry air above and a cloud below. The simulated brightness temperatures for AMSU-B are plotted in Figure 2. The surface emissivity for this track was set at 0.9 in the simulation. There is very little thermal contrast in the low cloud, and consequently little change in

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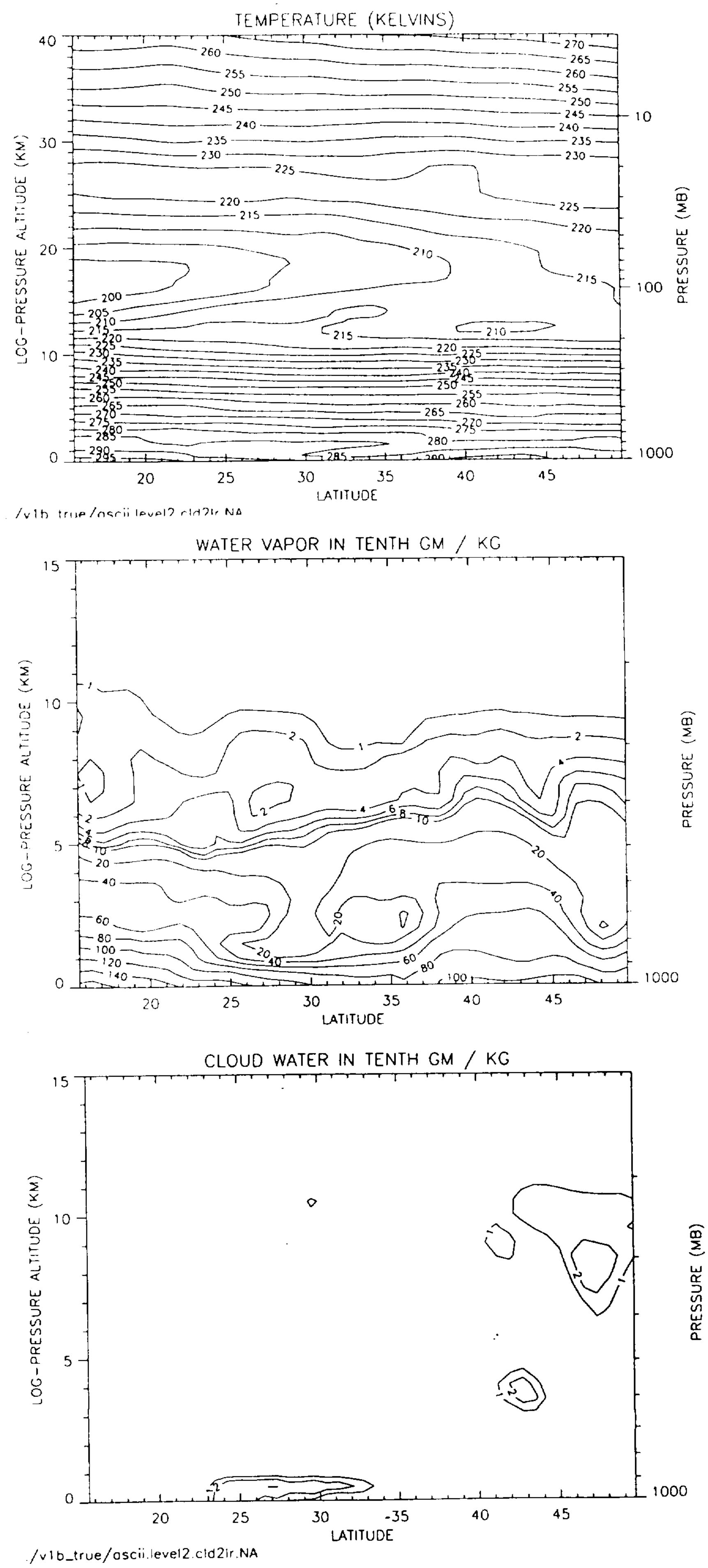
[1] P. Rosenkranz, IEEE Trans. Geosci. Rem. Sens. **33**, 1135-1140 (1995).
[2] H. Sundqvist, E. Berge, and J.E. Kristjansson, Mon. Wea. Rev. **117**, 1641-1657 (1989).

brightness temperature over it. Figure 3 shows the retrieved temperature, water vapor and liquid water. The low cloud was not retrieved, although the cloud near 4-km altitude toward the northern end of the track does have a counterpart in the retrieval.

Investigation of cloud-clearing for AIRS continued, using the training set profiles for the two-layer cloud simulation. Figure 4 is a diagram of the cloud-clearing algorithm being developed. The approach is to characterize the impact of clouds on the IR radiances by using both IR and microwave radiances to estimate cloud parameters. Each IR channel (at 15-km resolution) is corrected for the estimated cloud contamination and then a weighted combination of nine spots is taken to represent cloud-cleared radiance at 50-km resolution. The weights are selected to minimize errors. No adjacent-field comparisons such as N* are used, although future development of the algorithm will remedy this. Figure 5 shows the error remaining from this algorithm when tested on the AIRS 2-layer cloud test tracks NA and NC. The "*a priori*" curve is the rms difference between the clear and cloudy radiances before correction. These results were reported at the AIRS team meeting in Baltimore, MD.

Figure 1.



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PRESSURE (MB)
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WATER VAPOR IN TENTH GM / KG
LOG-PRESSURE ALTITUDE (KM)
PRESSURE (MB)
LATITUDE
CLOUD WATER IN TENTH GM / KG
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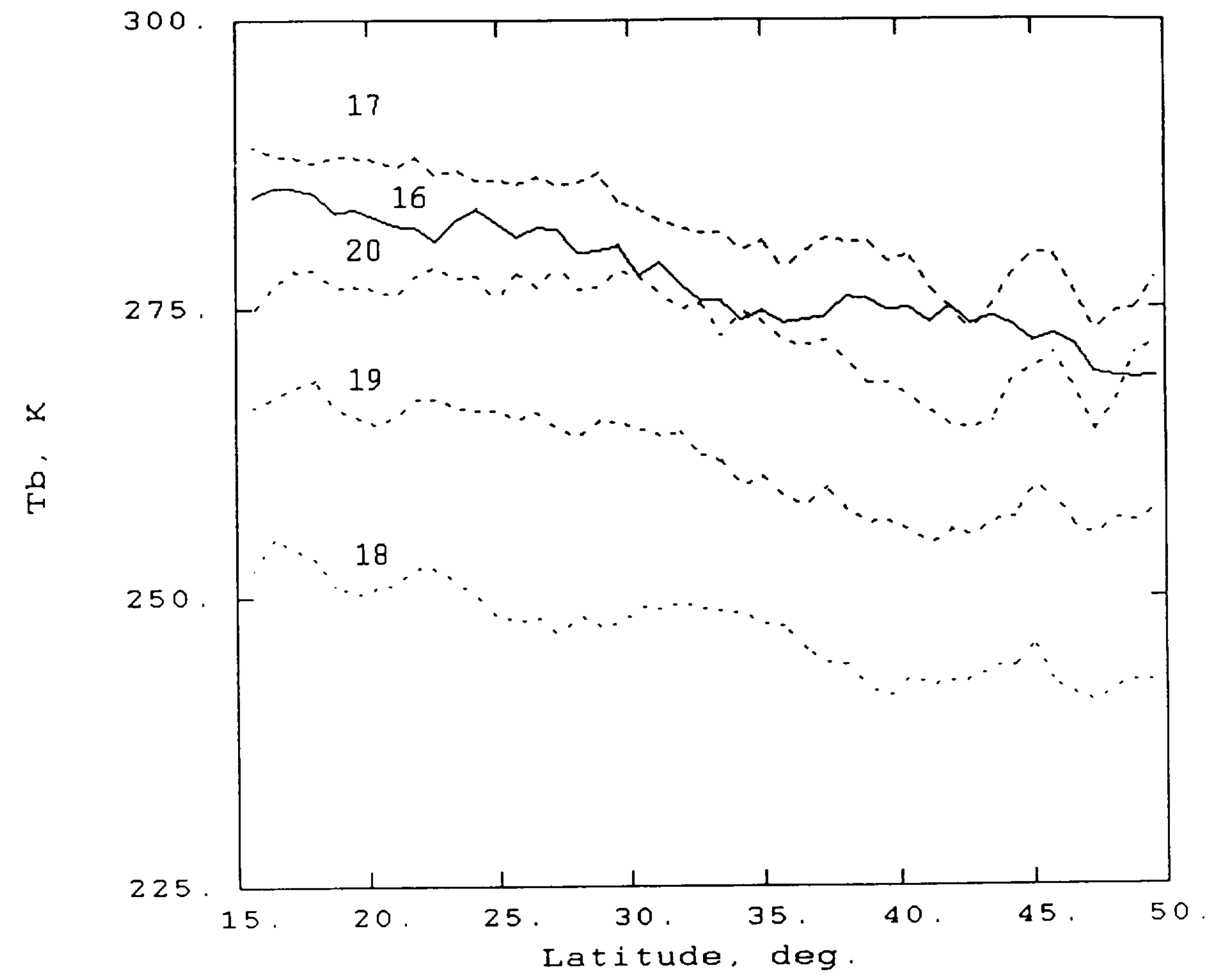
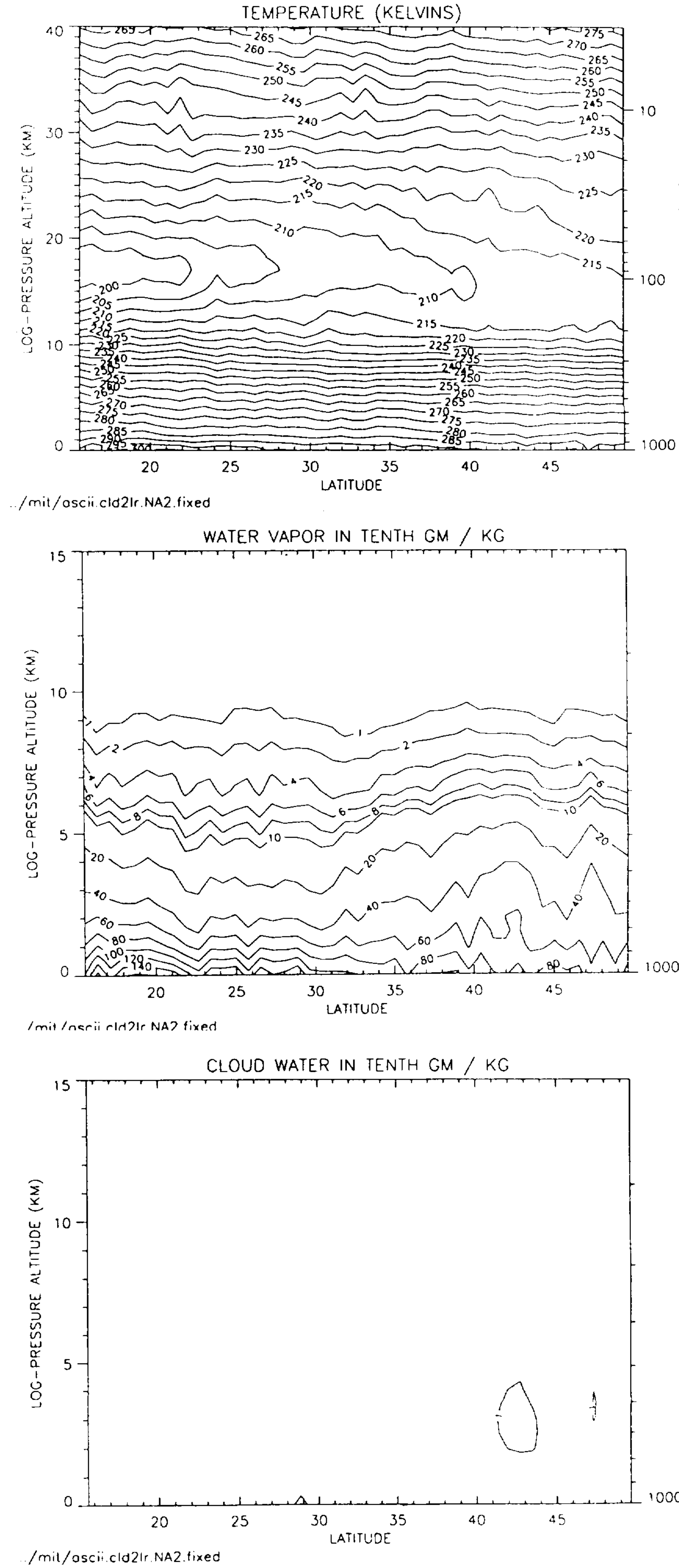


Figure 2. AMSU-B brightness temperatures corresponding to Figure 1. Channel 16- 89GHz; 17- 150GHz; 18- 183±1GHz; 19- 183±3GHz; 20- 183±7GHz.

Figure 3.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CLOUD WATER IN TENTH GM / KG
LOG-PRESSURE ALTITUDE (KM)
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Figure 4.

AIRS/AMSU CLOUD CLEARING ALGORITHM

AVERAGING CLEARED 15-KM SPOTS

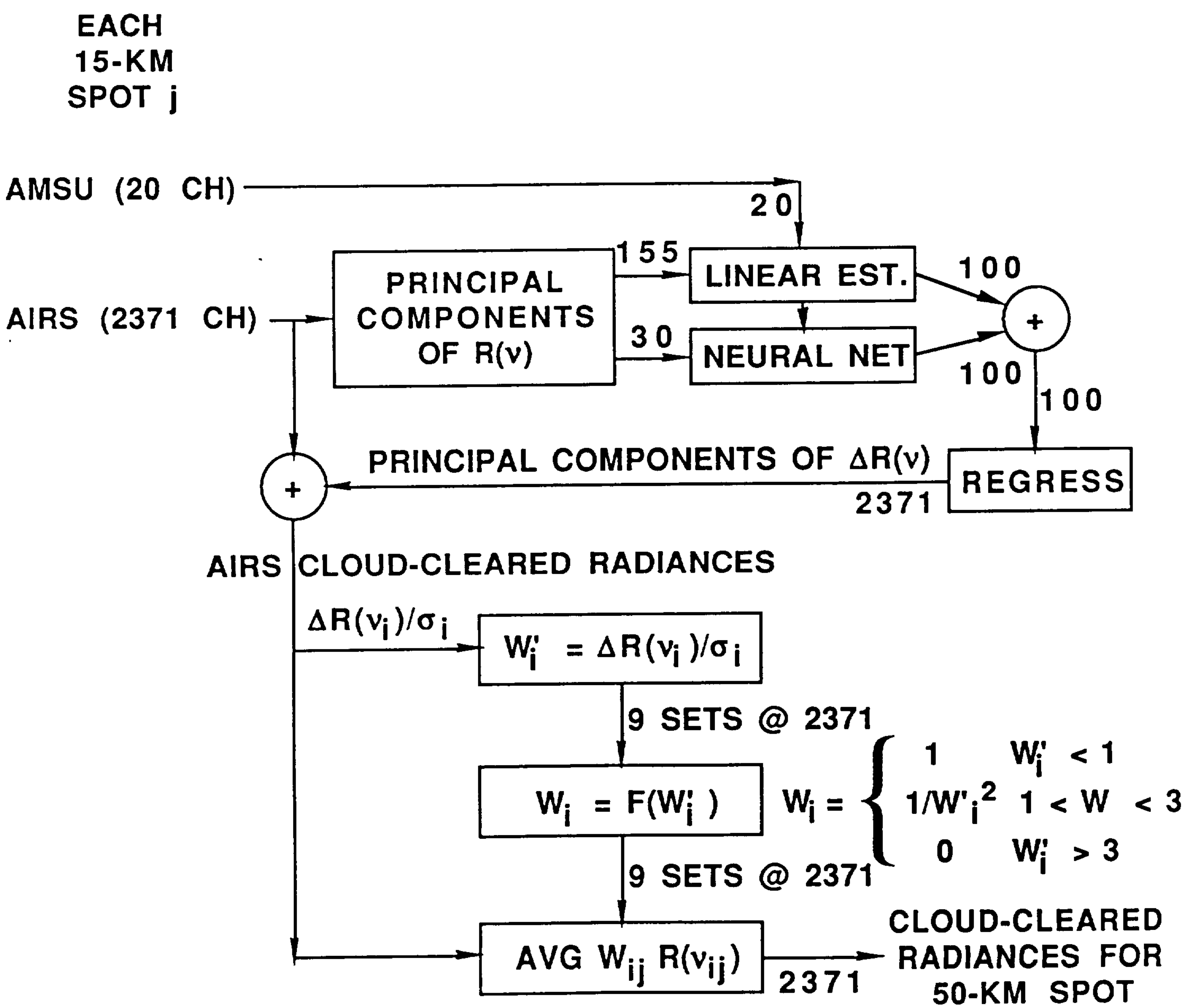
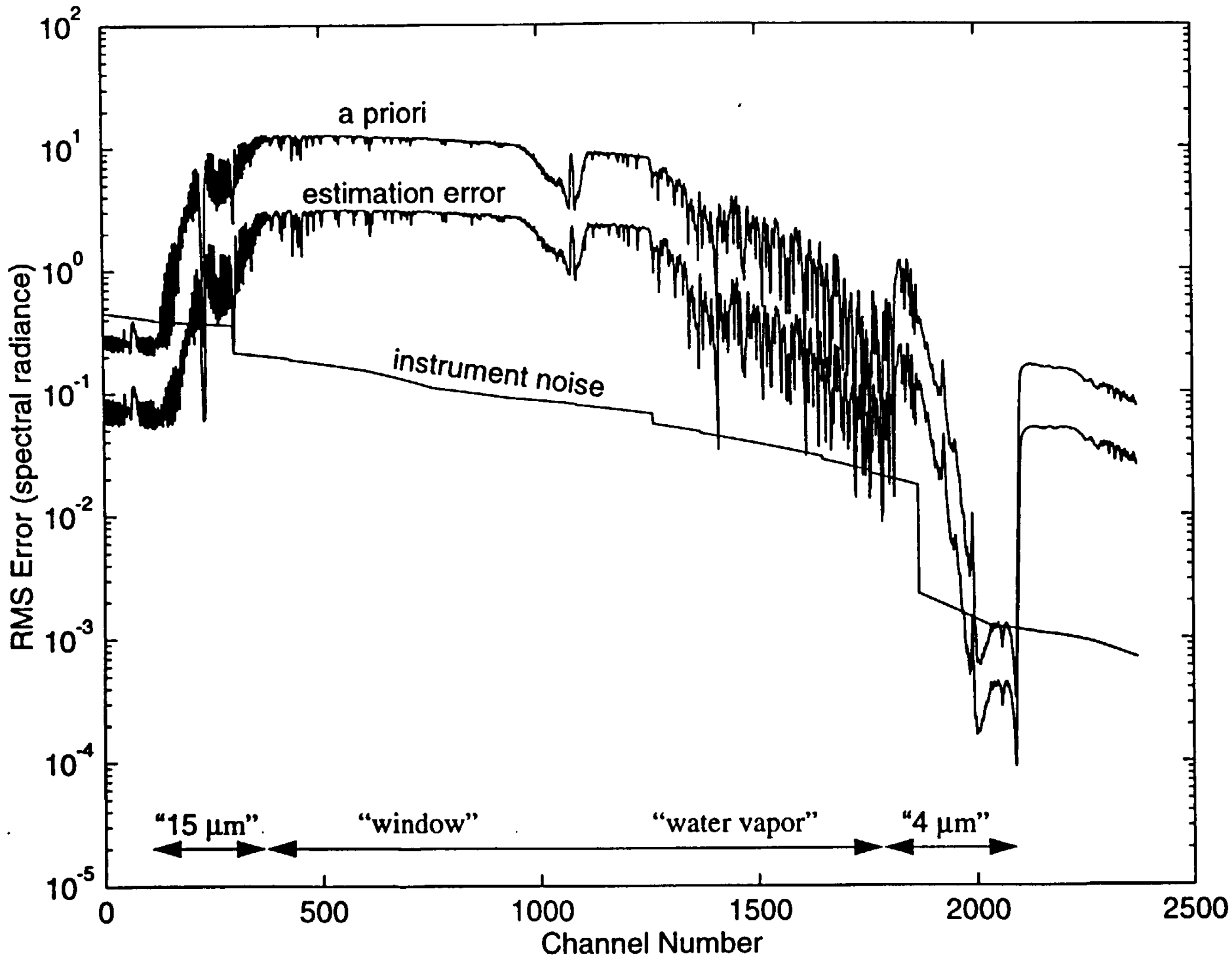


Figure 5.

Channel Cloud-Correction Error



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15. Supplementary Notes

This report summarizes the activities of AIRS Team Members P.W. Rosenkranz and D.H. Staelin during the second half of 1995.

16. Abstract

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